Strong Ground Motion Simulations for Dunedin: First steps using the SCEC Broadband Simulation Platform

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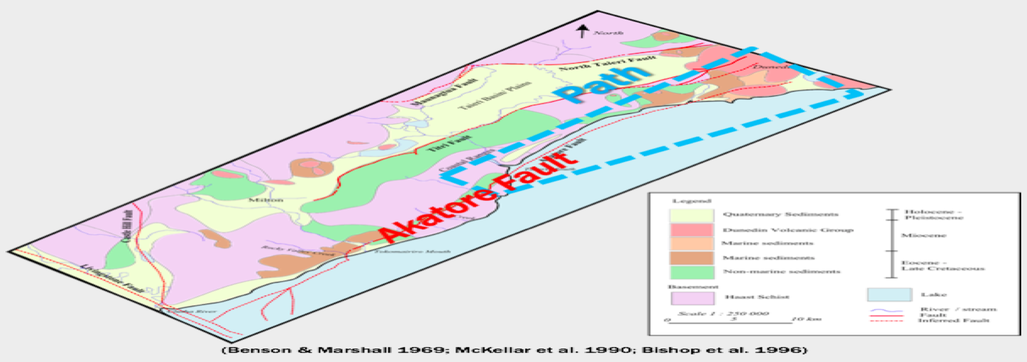
Overivew and objectives

The poster presents on-going Quake-core founded work on ground motion simulations for the Dunedin Central Business District. The project addresses low seismicity area's seismic hazard and risk, that has been neglected for a long time.

The overarching aim is to improve seismic hazard analyses and prediction for Otago region and encourage research that makes contribution for New Zealand's seismic hazard analysis, as a whole.

Method



(Benson & Marshall 1969; McKellar et al. 1990; Bishop et al. 1996)

Figure 1: Schematic position of source and path on the geological structure of the area

Physic-based source modelling and ground motion simulations are being carried out using the SCEC (The Southern California Earthquake Center) Broadband Simulation Platform (SCEC BBSP). The platform computes broadband (0-10Hz) seismograms for earthquakes. As large earthquakes have not been experienced in Dunedin in the time period of instrumental recording, user-specified scenario simulations are of great value. The Akatore Fault (Figure 1), the most active fault in Otago and closest major fault to Dunedin, is the source focused on in the present stage of the study. Simulations for various Akatore Fault source scenarios are run and presented. Path and site effect are key components considered in the simulation process.

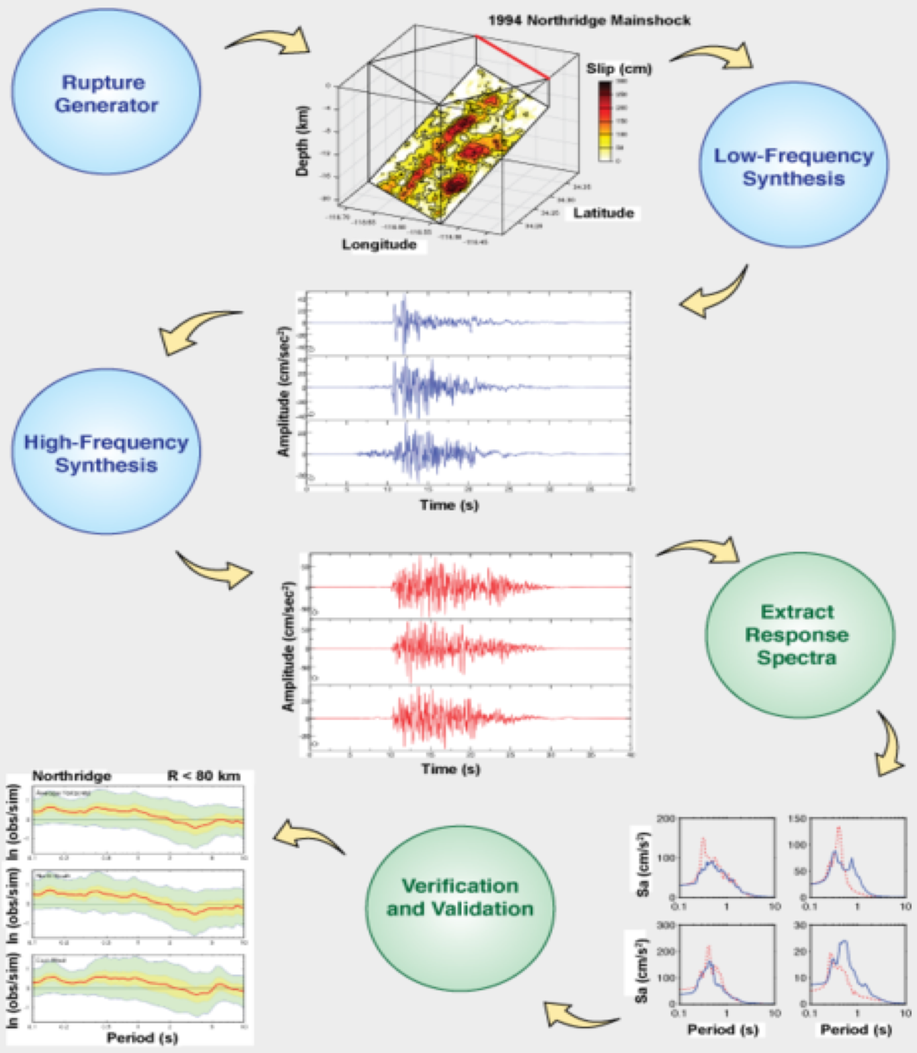


Figure 2: SCEC BBP shame workflow (SCECpedia, 2018)

Velocity modelling

A 1D shear velocity profile is required by SCEC BBP, and this is being generated to represent the Akatore-to-CBD path and site and then matched with the most similar region supported by BBSP (Figure 3). A 3D shear wave velocity model, with high resolution within Dunedin CBD, is being developed in parallel with this study (see Sangster et al. poster). This model will be a basis for developing 3D shear velocity model for greater Dunedin-Mosgiel for future ground motion simulations, possibly using University of Canterbury software.

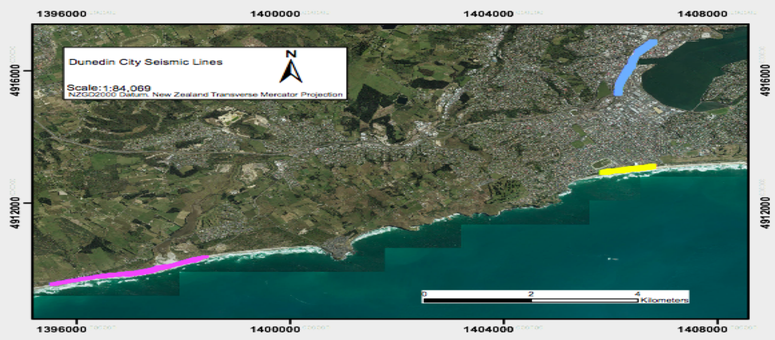


Figure 3 map with three seismic lines acquired in the scope of the project: Kaikorai (purple), Railway (blue) and Kettle Park (yellow).

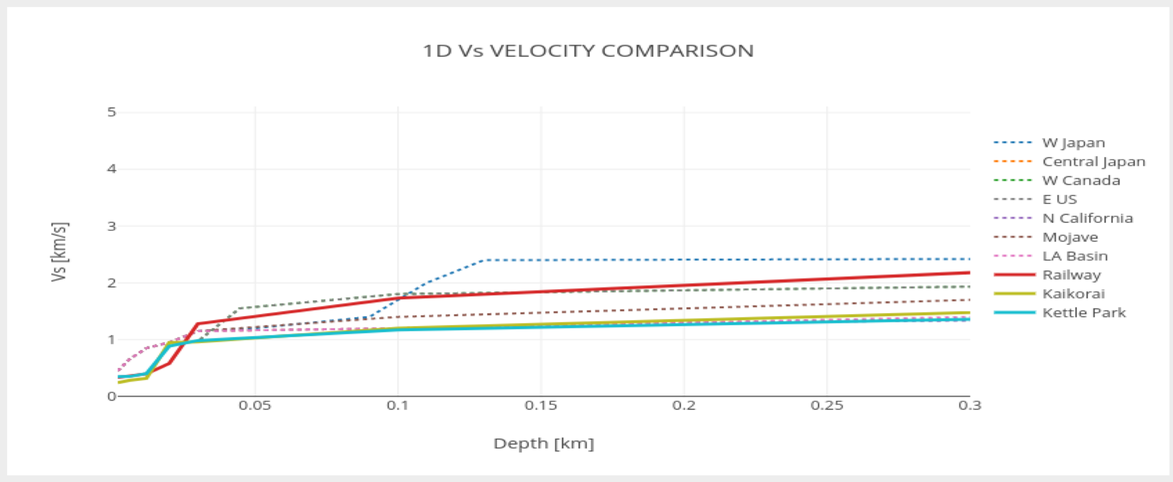
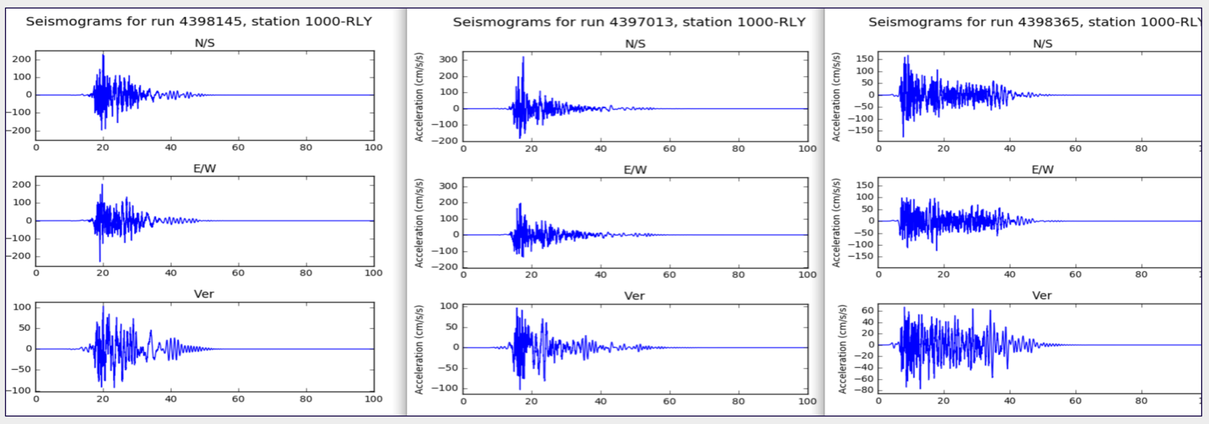


Figure 4: 300m Vs profiles comparison between BBP supported models and three seismic lines acquired withinthe research (Figure 3) in the area of interest.

Simulations result example

(a)



(b)

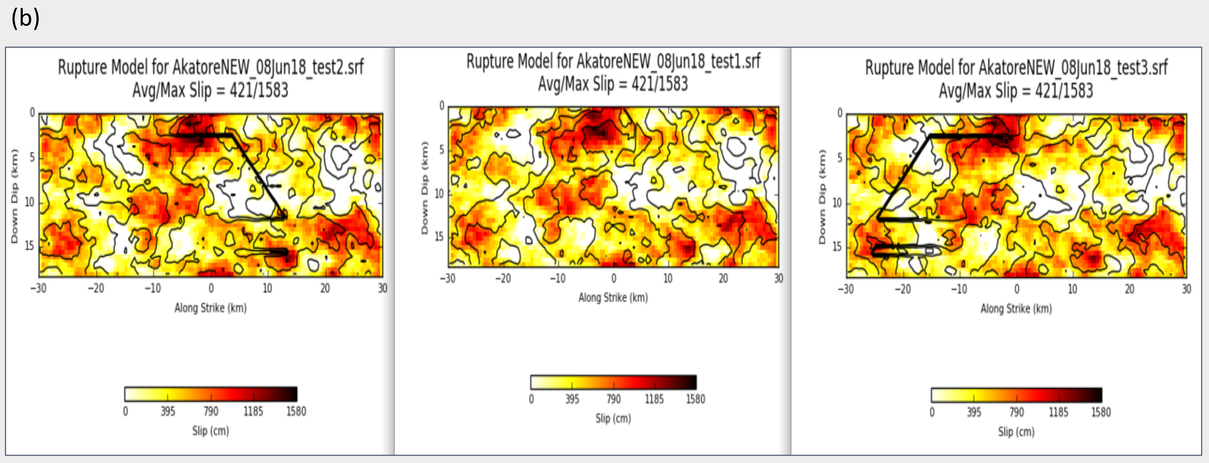


Figure 5: Simulations results for 60 km fault length, Mw = 7.4. From left to right hypocenter located in southern, central and northern part of the fault (a) Synthetic acceleration seismograms (b) Repture models – slip distribution along fault plane.

Wider context of work and future challenges

- Integrating simulations with 3D velocity model
- Moving 1D ground motion simulations to 3D
- Expanding 3D model to cover wider Otago Region area
- Running 3D earthquakes simulations for multiple sources and stations
- Improving seismic hazard analyses and prediction for Dunedin

Acknowledges

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